

Averting a global fisheries disaster

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Oceans cover 71% of Earth's surface and support an estimated 3 billion people with food and vital micronutrients (1). Consequently, the fate of the ocean and its living resources is a first-order question in ecology and environmental science (2). In this context, a 2006 panel of ecologists and fisheries scientists empirically charted the consequences of an ongoing depletion of marine biodiversity, such as declining fisheries, reduced water quality, loss of habitat, and less resilient ecosystems (3). The paper became widely known, however, for a scenario of global fisheries collapse derived from extrapolating catch trends to the year 2048. This projection served as a flash point in the ongoing discussion about the sustainability of global fisheries, or lack thereof (4). A polarized debate ensued, which was productively addressed by a subsequent panel that highlighted solutions for rebuilding depleted fisheries, where appropriate governance structures exist (5). That work, however, along with several follow-up papers (6–8), did not revisit the original projections. A new paper in PNAS (9) now uses updated methodology and an innovative combination of available data on catch trends, life history, and stock assessments to revisit the prospect of a global fisheries disaster, and what may be required to avert it.

The analysis of Costello et al. (9) confirms that the average state of global fish stocks is poor and declining. Of 4,714 fisheries assessed in the year 2012, only 32% remained at or above the biomass target that supports maximum sustainable yield (B_{MSY}), whereas 68% have slipped below that critical threshold. This compares to 63% of assessed stocks tracking below B_{MSY} in 2006 (5). Even more concerning is the finding that only 35% of stocks are currently fished at a level that would allow for recovery toward the B_{MSY} target. This means that most overfished stocks will experience further depletion, despite their compromised status. An astounding 118 fisheries were mismanaged at mortality rates more than 10-fold the sustainable target, and 3 had greater than 100-fold higher mortality. If fish stocks were financial assets, most would indeed represent a poor choice for investors.

Feeding these data into a simple bioeconomic model unsurprisingly reveals further depletion and

collapse of stocks under a business-as-usual scenario (Fig. 1). The authors calculate that, under current management, 88% of stocks would be overfished and well below their target biomass in 2050. For comparison, the Food and Agriculture Organization of the United Nations estimates that 29% of assessed major stocks currently are overexploited or depleted (1). Without a doubt, global fisheries are in for a hard landing if nothing changes. This is especially sobering as several of the authors reporting in PNAS today have previously championed a decidedly more optimistic outlook (4). At the same time, these findings sharpen our focus on much-needed solutions.

In addition to business as usual, the authors ran two other model scenarios, both assuming instantaneous global management intervention (Fig. 1). The first scenario assumes that all fisheries will be exploited at a rate that is predicted to sustain long-term maximum sustainable yield (MSY). In other words, management is being optimized for maximum catch, whatever the cost may be. This is close to current policy mandates, as enshrined for example in the United Nations Convention on the Law of the Sea. This strategy is projected here to result in slow recovery, such that 85% of stocks are approaching B_{MSY} in 2050. Essentially, this would reverse the proportion of overfished versus healthy stocks compared with business as usual. Even more striking, a scenario that is geared to optimize long-term profits (as opposed to yield) may produce even better outcomes, with 97% of stocks within reach of the biomass threshold B_{MSY} by 2050. Total biomass summed across all stocks would more than double, and profits would more than triple compared with business as usual (Fig. 1). Clearly, current management practices are not just hurting biodiversity and our food supply; they also make poor economic sense. This is particularly visible in countries where overfishing has been more pronounced, such as China, Indonesia, and India: the study shows that these countries have most to gain from comprehensive fisheries reform, both in terms of food security and economic advantage.

So how do we get from here to there? Overfishing is an interesting problem in that the solution is

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